Review of Mesozoic Exploration Plays in the Montenegro - NW Albania Segment of South Adriatic Basin*

Zamir Bega[1] and Z. Schleder[2]

Search and Discovery Article #10979 (2017)**
Posted August 7, 2017

*Adapted from oral presentation given at AAPG 2017 Annual Convention and Exhibition, Houston, Texas, April 2-5, 2017

[1]Consultant, Tirana, Albania (begazamir447@gmail.com)
[2]Exploration, OMV Petrom, Bucharest, Romania

Abstract

We suggest that Montenegro and NW Albania share the same Mesozoic platform plays. The basis for this model is the vast geological and geophysical data gathered during mid-90's and early 2000. This data set can be interpreted so that it allows for the presence of another hydrocarbon province yet to be found in the NW Albania–Montenegro region. This new play consists of deep seated contractional structures made up of Mesozoic platform units that are buried underneath the frontal zones of the thin-skinned Kruja - Dalmatian thrust belt. We use two balanced regional profiles that connect on-, and offshore Montenegro and Albania, respectively, to speculate on the structural configuration of the shallow and the deep levels. The shallow, thin-skinned thrust belt has a westward vergence with the structures implying a shortening of about 50 kilometres. The main detachment horizon is the Oligocene shales for this level. Seismic and gravity data suggests that this thin-skinned belt was subsequently folded by a deeper system of thrusts. These deep thrust slices are interpreted to detach on the Triassic salt level and accommodate shortening of about 10 km. At shallower levels, both shortening are accommodated by regional back thrusts (Durres-Palla and Ishem-Preza-Rodoni). We suggest that the most important play type in this area is this structurally inverted platform carbonates. These deeply buried platform carbonate antiforms resemble those in the Southern Apennines of Italy. Likewise in Southern Apennines, the Cretaceous marls and shales are considered as primary oil and wet gas prone source rocks. A deep SE-NW trending anticlinorium with platform carbonate units is interpreted in onshore Albania–Montenegro region. The anticlinorium, which is stretched for about 140 km towards onshore Montenegro comprises a cluster of several structural closures. The structural inversion is relatively young and it is related to post-Miocene deformations.

Selected References

Bega, Z., 2015, Hydrocarbon Exploration Potential of Montenegro – A Brief Review: Journal of Petroleum Geology, v. 38/3, p. 317-330.

Bega, Z., 2013, Deep Seated Platform Carbonate Reservoirs as New Hydrocarbon Plays in the NW Albania-Montenegro Segment of the Adriatic Region: AAPG European Regional Conference & Exhibition, Barcelona, Spain, April 8-10, 2013, Search and Discovery Article #10497 (2013). Website accessed July 2017.

Bega, Z., and Z. Schleder, 2016, Review of Mesozoic Exploration Plays in the Montenegro –NW Albania Segment of South Adriatic Basin: Abstract, AAPG European Regional Conference, Bucharest, 19-20 May 2016.

Bertello, F., R. Fantoni, R. Franciosi, V. Gatti, M. Ghielmi, and A. Pugliese, 2010?, Petroleum Geology: From Mature Basins to New Frontiers – Proceedings of the 7th Petroleum Geology Conference, *in* B.A. Vining and S.C. Pickering (eds.), Petroleum Geology Conferences Ltd.: Geological Society, London, p. 113-126.

Curi, F., 1993, Oil Generation and Accumulation in the Albanides-Ionian Basin, *in* A.M. Spencer (ed.), Generation, Accumulation and Production of Europe's Hydrocarbons III, EAPG Special Publication 3, p. 281-293.

Diamanti, F., 1995, Development of Oil Industry in Albania and Intellectual Contribution: Recent Developments in Exploration and Oil Production and the Future in Free Market Economy, ALBPETROL-95 Sympozium, Nov. 23-26, 1995, Fier, Albania.

Dragasevic, T., 1983, Oil Geological Exploration in the Montenegro Offshore in Yugoslavia: Nafta, v. 34 /7-8, p. 397-404.

Dragasevic, T., 1987, Dinarides – A Challenge to Yugoslav Geophysicists: First Break, v. 5/5, p. 173-183.

Dubljevic, V., 2013, Oil and Gas in Montenegro. Ministry for Economic Development, Government of Montenegro.

Flores, G., 1991, Introduction to the Petroleum Geology of the Italian offshore. At Sedimentary Basins of Mediterranean margins, in F.C. Weel (ed.), C.N.R Italian Project of Oceanography, p. 505-520.

Frasheri, A., N. Kapedani, R. Lico, B. Canga, and L. Jareci, 1995, Geothermy of External Albanides: Recent Developments in Exploration and Oil Production and the Future in Free Market Economy, ALBPETROL-95 Sympozium, Nov. 23-26, 1995, Fier, Albania.

Frasheri, A., S. Bushati, and V. Bare, 2009, Geophysical Outlook on Structure of the Albanides: Journal of Balkan Geophysical Society, v. 12/1, p. 9-30.

Glavatovic, B., 2007. Seismogenic Model for Montenegro: Overview of Relevant Data. First Workshop for the NatoScience for Peace Project, No. 983054, 7-9 November 2007, Slovenia.

Jerinic, G., V. Jelaska, and A. Alajbeg, 1994, Upper Cretaceous Organic-Rich Laminated Limestones of the Adriatic Carbonate Platform, Island of Hvar, Croatia: American Association of Petroleum Geologists Bulletin, V. 78/8, p. 1313-1321.

Malvic, T., M. Durekovic, Z. Sikonja, Z. Cogelja, T. Iljas, and I. Kruljac, 2011, Exploration and Production Activities in Northern Adriatic Sea (Croatia), Successful Joint Venture INA (Croatia) and ENI (Italy): NAFTA 62 (9-10), p. 287-292.

Mattavelli, L., L. Novelli, and L. Anelli, 1991, Occurrence of Hydrocarbons in the Adriatic Basin *in* A.M. Spencer (ed.), Generation, Accumulation and Production of Europe's Hydrocarbons III: EAPG Special Publication 3, p. 369-380.

Mattavelli, L., M. Pieri, and G. Groppi, 1993, Petroleum Exploration in Italy: A Review: Marine and Petroleum Geology, v. 10, p. 410-425.

Moldowan, J.M., P. Sundararaman, T. Salvatori, A. Alajbeg, B. Gjukic, C.Y. Lee, and G.J. Demaison, 1992, Source Correlation and Maturity Assessment of Select Oils and Rocks from the Central Adriatic Basin (Italy and Yugoslavia), *in* J.M. Moldowan, P. Albrecht, and R.P. Philp (eds.), Biological Markers in Sediments and Petroleum: Prentice Hall, Englewood Cliffs, N.J., 352 p.

Moorkens, T., and M. Dohler, 1994, Albania, *in* H. Kulke (ed.), Regional Petroleum Geology of the World: Part I: Beitraege zur regionalen Geologie der Erde, 21, part 1, p. 325-342.

Niuwland, D.A., B.C. Oudmayer, and U. Valbona, 2001, The Tectonic Development of Albania: Explanation and Prediction of Structural Styles: Marine and Petroleum Geology, v. 18, p. 161-177.

Picha, F.J., 2002, Late Orogenic Strike-Slip Faulting and Escape Tectonics in Frontal Dinarides-Hellenides, Croatia, Yugoslavia, Albania, and Greece: American Association of Petroleum Geologists Bulletin, v. 86, p. 1659-1671.

Picha, F.J, 1996, Exploring for Hydrocarbons Under Thrust Belts – A Challenge New Frontier in the Carpathians and Elsewhere: American Association of Petroleum Geologists Bulletin, v. 80/10, p. 1547-1564.

Radulevic, V., and M. Radulevic, 1997, Karst Crne Gore (Karst of Montenegro), *in* Z. Stefanovic (ed.), 100 Godina hidrogeologije u Jugoslaviji, Belgarde, p. 147-185 (in Serbian, with English summary).

Roure, F., S. Nazaj, K. Mushka, I. Fili, J.-P Cadet, and M. Bonneau, 2004, Kinematic Evolution and Petroleum Systems – An Appraisal of the Outer Albanides, *in* K.R. McClay, (ed.), Thrust Tectonics and Hydrocarbon Systems: American Association of Petroleum Geologists Memoir 82, p. 474-493.

Roure, F., P. Andriessen, J.L. Callot, H. Faure, H. Ferket, E. Gonzales, N. Guilacombe, J. Malandain, W. Sassi, F. Schneider, R. Swennen, and N. Vilasi, 2010, The Use of Palaeo-Thermo-Barometers and Coupled Thermal, Fluid Flow and Pore-Fluid Pressure Modelling for Hydrocarbon and Reservoir Prediction in Fold and Thrust Belts: Geological Society, London, Special Publications 2010, v. 348, p. 87-114.

Schmid, M.S., D. Bernoulli, B. Fugenschuh, L. Mateenco, S. Schefer, R. Schuster, M. Tischler, and K. Ustaszewski, 2008. The Alpine-Carpathian-Dinaridic Orogenic System: Correlation and Evolution of Tectonic Units: Swiss Journal Geoscience, Basel, v. 100, p. 215-225.

Sejdini, B., P. Constantinescu, and T. Piperi, 1994, Petroleum Exploration in Albania, *in* B. Popescu (ed.), Hydrocarbons of Eastern Central Europe: Springer-Verlag, Heidelberg, p. 1-28.

Shehu, H., 1995, Structural Model of Kruja Zone and its Exploration Perspective: Recent Developments in Exploration and Oil Production and the Future in Free Market Economy: ALBPETROL-95 Symposium, Nov. 23-26, 1995, Fier, Albania.

Speranza, F., I. Islami, C. Kissel, and A. Hyseni, 1995, Paleomagnetic Evidence for Cenozoic Clockwise Rotation of the External Albanides: Earth and Planetary Science Letters, v. 129, p. 121-134.

Veizaj, V., and A. Frasheri, 1995, The Relation of Orogene in Albanides with Apulia Platform through Gravity Studies: Recent Developments in Exploration and Oil Production and the Future in Free Market Economy, ALBPETROL-95 Symposium, Nov.23-26, 1995, Fier, Albania.

Velaj, T., 2012, Tectonic Style and Hydrocarbon Evaluation of Duplex Kruja Zone in Albania: NAFTA, v. 63/7-8, p. 236-242.

Zappaterra, E., 1990, Carbonate Paleogeographic Sequences of the Periadriatic Region: Bolletino Societa Geologico Italiana, v. 109, p. 5-20.

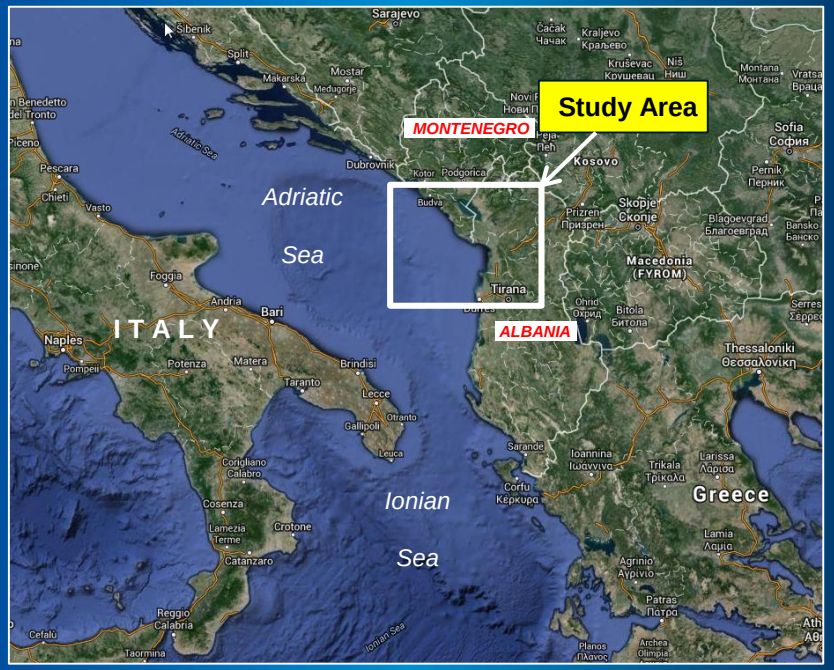
Zappaterra, E., 1994, Source Rock Distribution Model of the Periadriatic Region: American Association of Petroleum Geologists Bulletin, v. 78/3, p. 333-354.

Review of Mesozoic Exploration Plays in the Montenegro – NW Albania Segment of South Adriatic Basin

Presented at AAPG, May 19-20, 2016, Bucharest Romania

Z. Bega , Consultant , Tirana, Albania
Z. Schleder, OMV Petrom, Romania

Houston, ACE April 2-5, 2017.



OMV Petrom

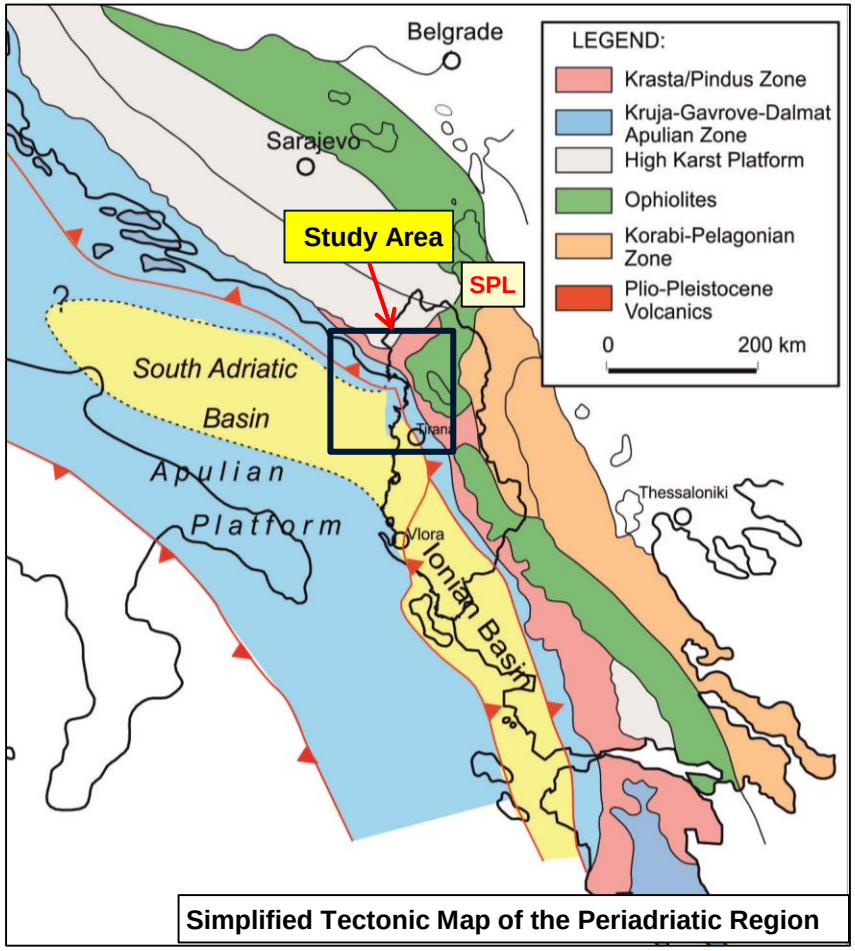
Content

- Study Area
- Regional Tectonic Framework
- Key Paleo-geographic Units and Petroleum System
- Forward Thrust Modelling of Two Regional Transects: First Pass.
- Major Mesozoic Plays Through Seismic Examples
- Conclusions

Study Area:
Montenegro – NW Albania Segment

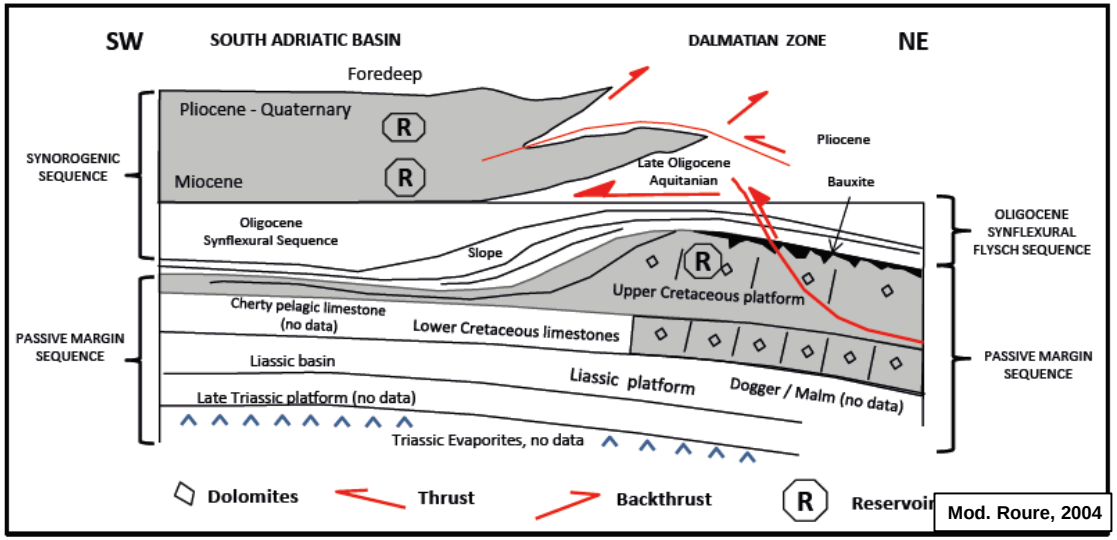
- Study area comprises the SE edge of the South Adriatic Basin (SAB), partly masked by westward verging thrust sheets of Dinarides-Albanides fold-and-thrust belts.

- The geo-dynamic model has been strongly controlled by:
  - Mesozoic post- rift architecture
  - the post- Oligocene CWR of Dinarides – Albanides fold belts
  - the deep-rooted Scutari-Pec Transversal Lineament (SPL).

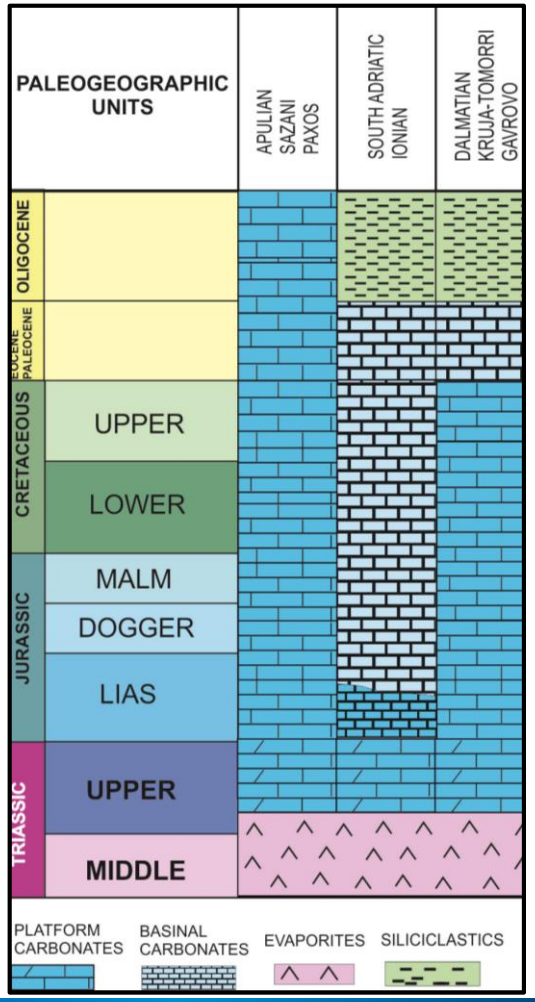


Simplified Tectonic Map of the Periadriatic Region

South Adriatic Basin:
Key Paleogeographic Units



Mod. Roure, 2004

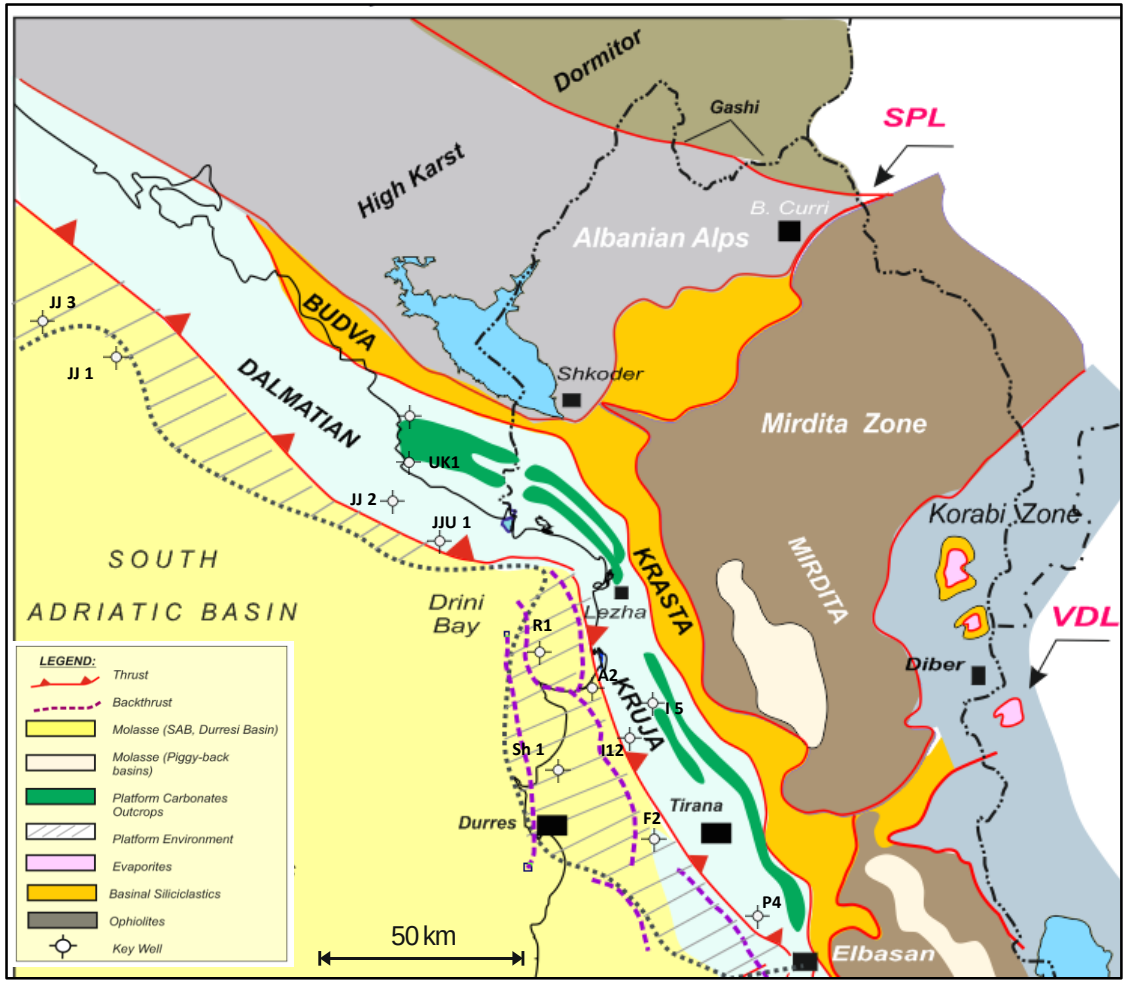


Apulian Foreland ramp:

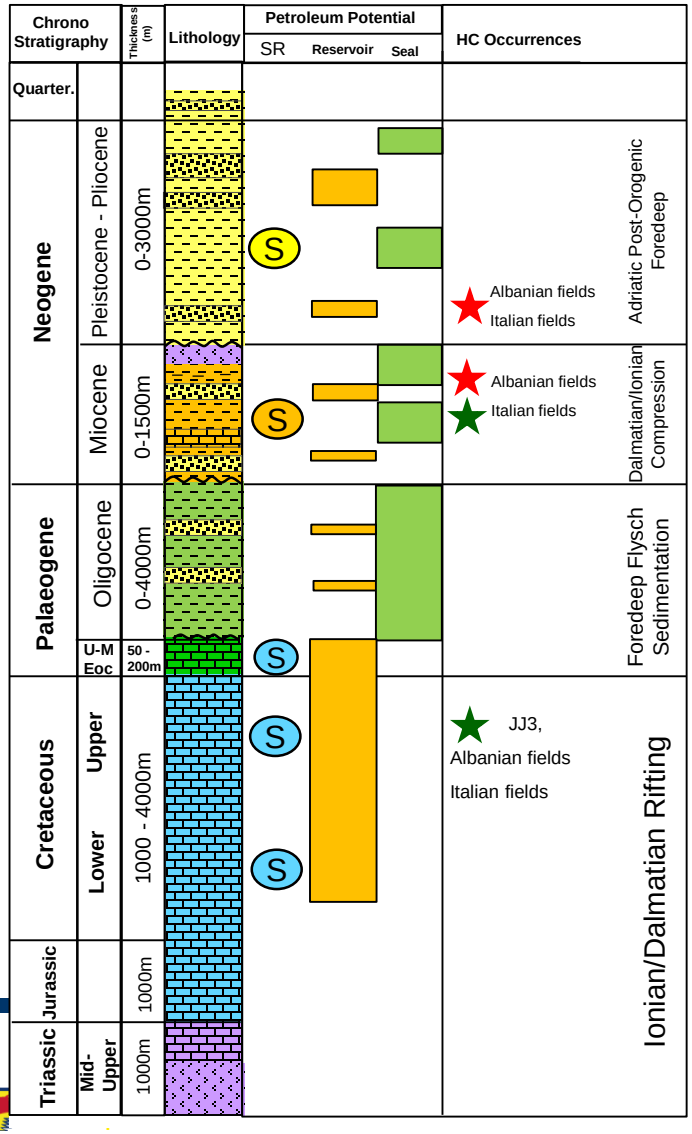
- Persistent shallow-water deposition conditions over Apulia-Dalmatian-Kruja throughout Mesozoic (~ 5 – 7 km thick).
- Deep water condition within SAB/Ionian basins, post-Early Jurassic (~ 2.5 – 3.0 km thick).
- Post-Oligocene thrusting continued up to the Pliocene, causing:
  - Dalmatin-Kruja thin-skinned thrusts.
  - Inversion and thrusting of the thick-skinned sequence.
  - Two parallel sets of Neogene back-thrusts due to thin- and thick-skinned deformation.
  - Eastward tilting of the Apulian foreland.

Tectonic Map:
Close Up View

- **Three major tectonic elements are present:**
  - Undeformed foreland (South Adritatic Basin) to the West
  - Deformed foreland (Central)
  - Dalmatian-Kruja thin-skinned assemblage to the East
- **Diverted orientation across the SPL.**
- **A series of regional Neogene back-thrust systems** are observed on the Albanian side, which are missing entirely in Montenegro.
- The backthrusts are facilitated by:
  - Larger overall thrust displacement is in the South.
  - Sub-surface morphology (thin- and thick-skin buried geometries).



Petroleum Systems
Montenegro-NW Albania



Reservoir
Pleistocene-Pliocene-Miocene turbidite sands
Oligocene turbidite sands
Cretaceous – Eocene shelf edge & platform carbonates

Source
Mid Eocene – Cretaceous shale and marls, as primary oil and wet gas prone
Plio-Miocene shale – dry gas prone

Traps
Carbonate shelf margin reef / topographic buildups
Structural closures of autochthonous platform carbonates structures
Structural and stratigraphic traps (Tertiary turbidite)

Seal
Intra formation shale of Pleistocene-Pliocene-Miocene
Oligocene deep water shale as regional top seal for platform carbonates

Plays
Pleistocene-Pliocene-Miocene sands charged with dry gas
Oligocene sands charged with wet gas
- **Platform and shelf margin charged with Eocene-Cretaceous oil**
- **Inverted structural closures of autochthonous platform carbonates**

Bega, 2015

Oil field
Gas field

OMV Petrom

Rationale

Outstanding question:

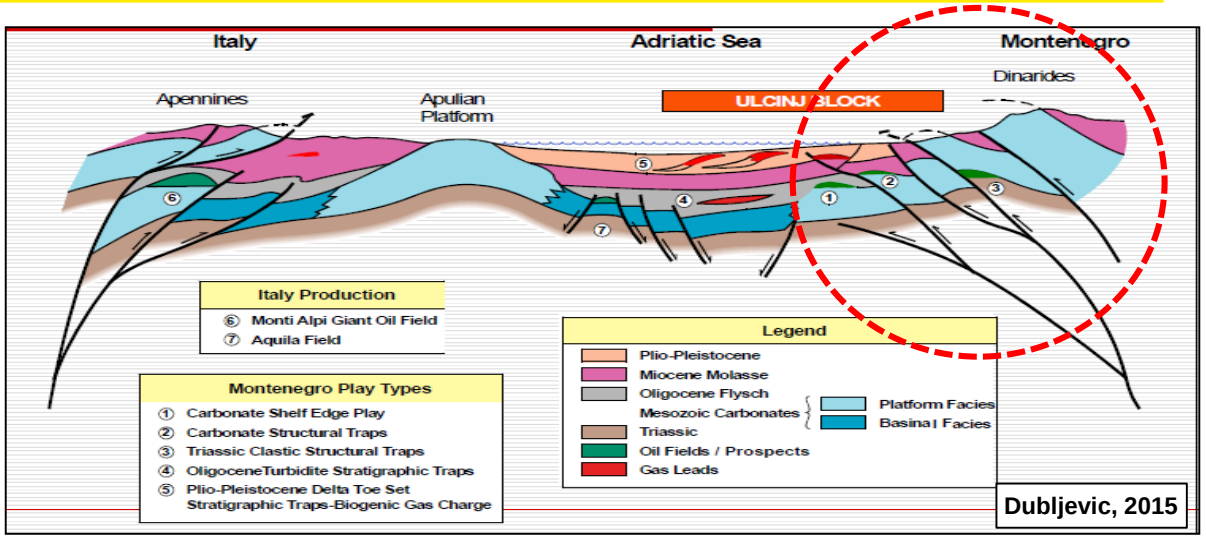
- Different structural models have been proposed for Mesozoic plays in Montenegro and NW Albania segment.
- The implications: different key plays to deal with.

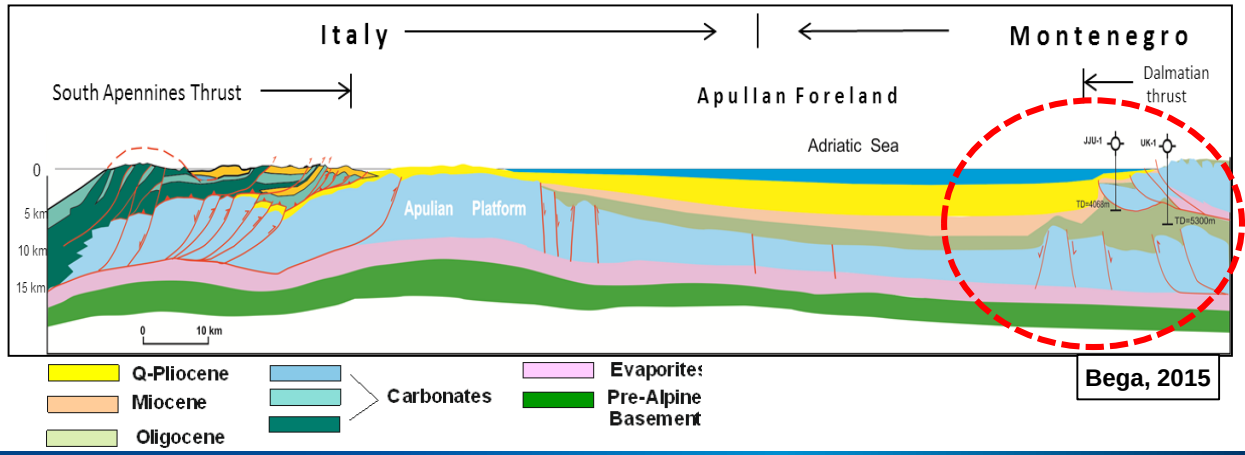
Approach:

- Forward thrust model: 1st pass
- Structural modelling only; w/o geochemical constrain.

Goal:

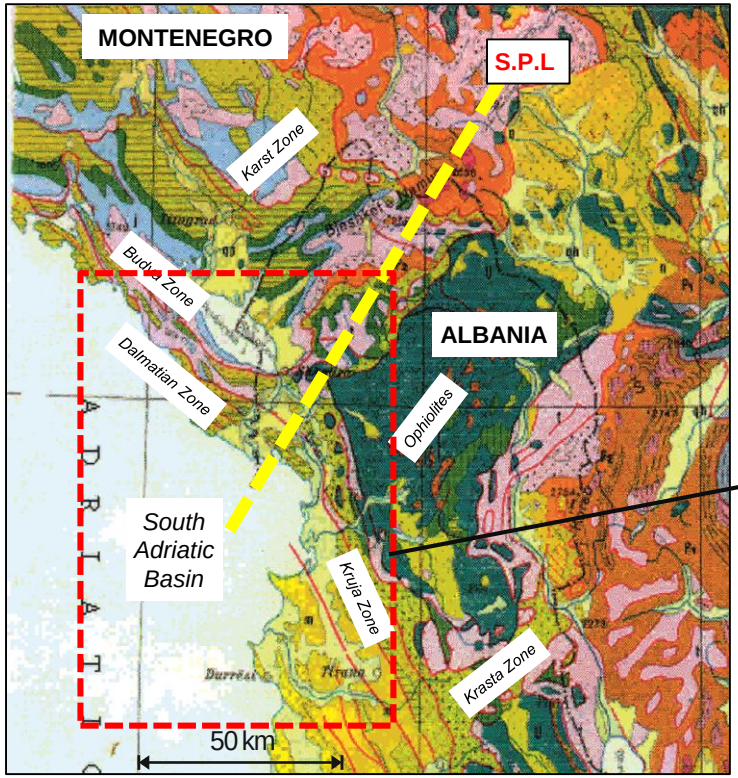
- Demonstrate the most likely structural model in North and South of SPL
- Demonstrate same litho-stratigraphy for thin- & thick-skin assemblage.
- Help to validate the Mesozoic plays in both sectors

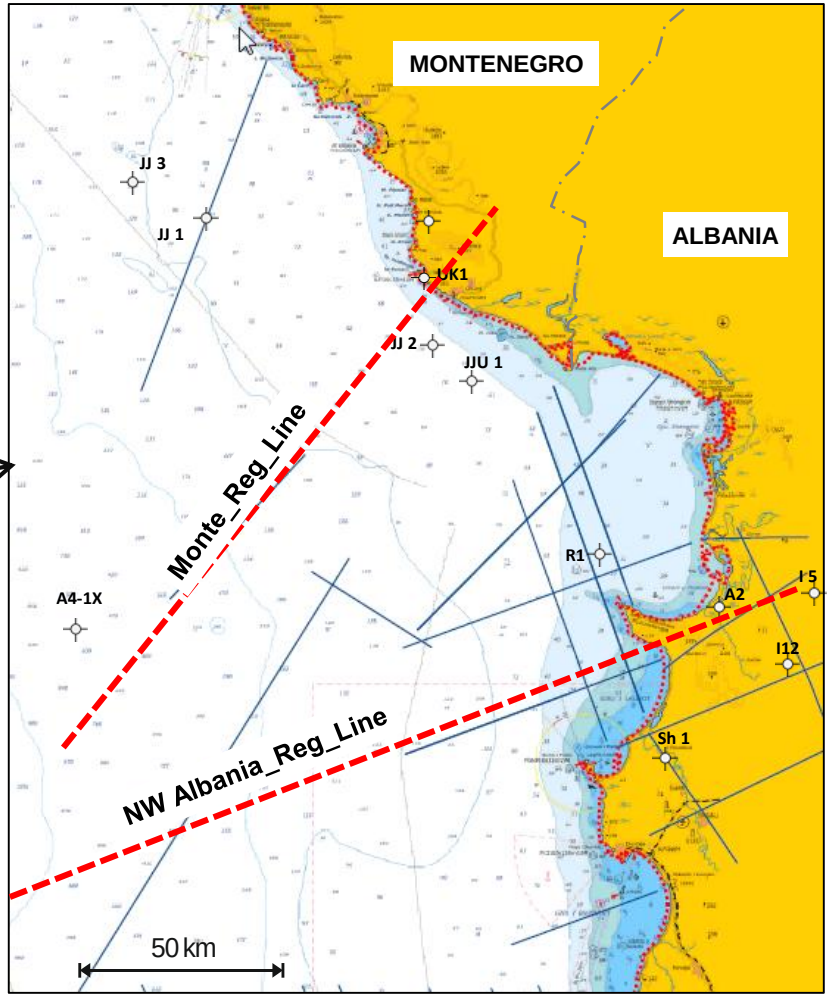




Data Base

Geological & Geophysical Data Base

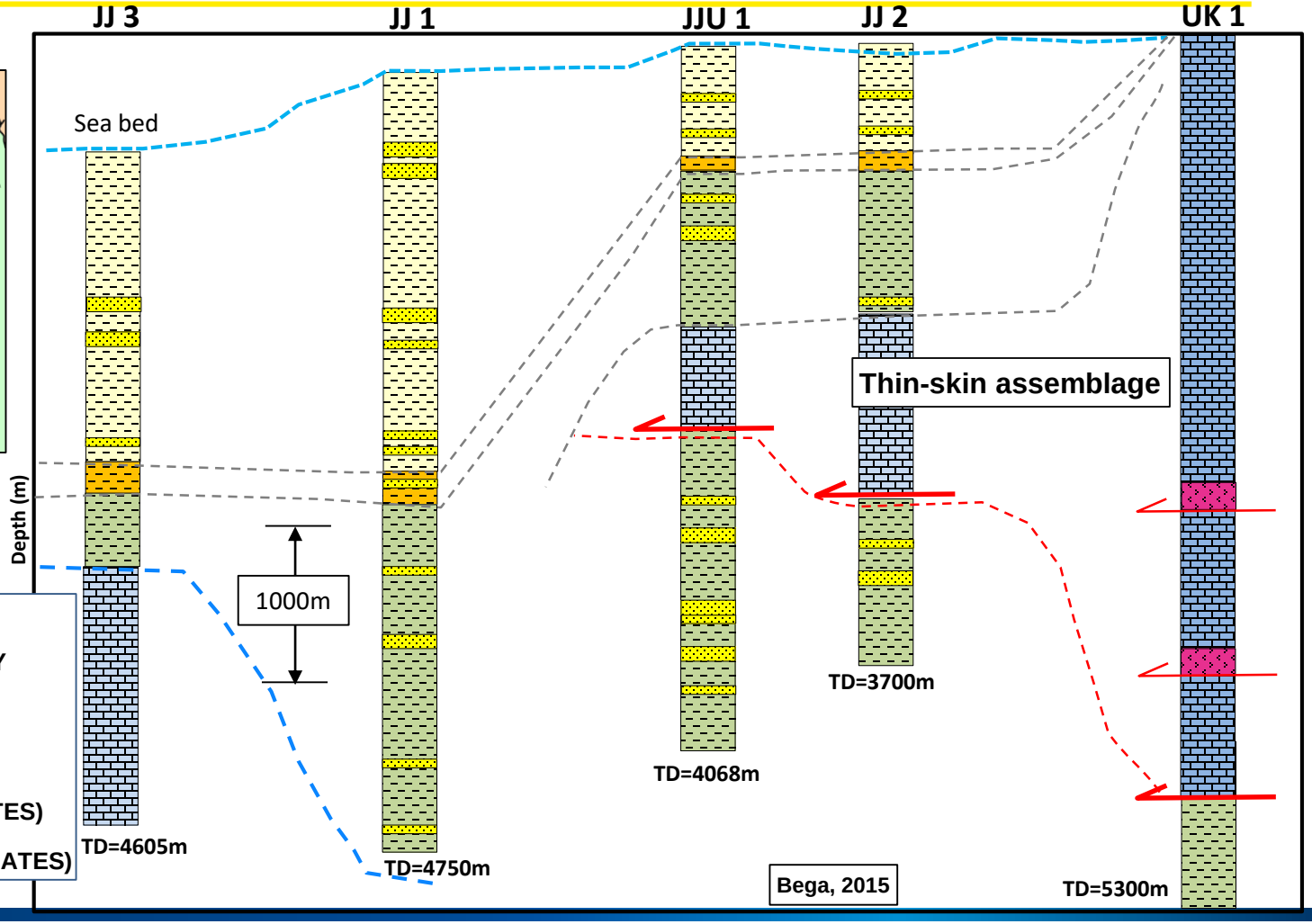




- Geological maps combined with Google Earth 3D topo view.
- Key seismic lines; handful of deep wells (formation tops); and velocities have been used to build the depth model.
- Two transects have been selected on each side of SPL
- The transects are almost perpendicular with structural trends

OMV Petrom

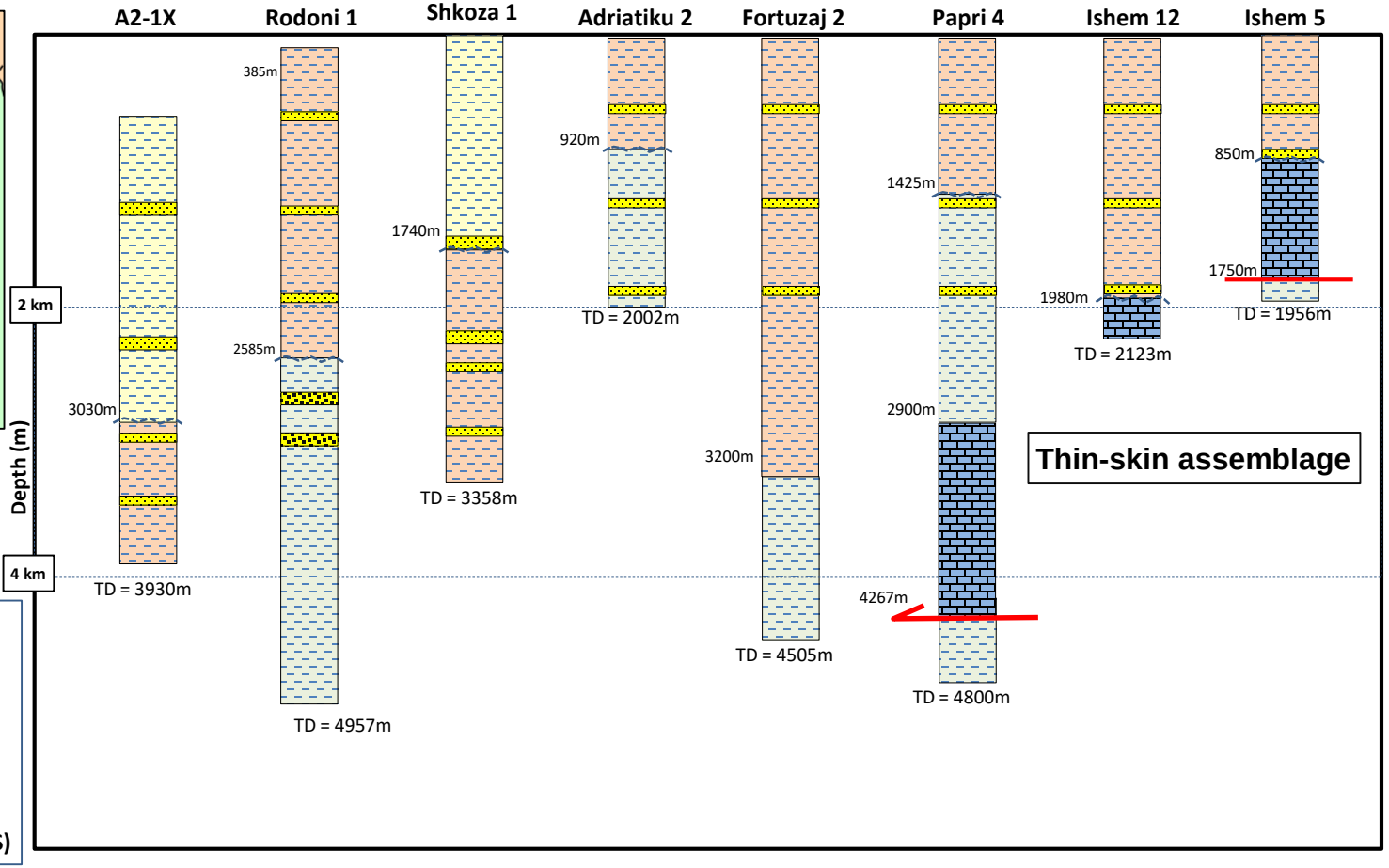
Montenegro:
Off – Onshore Key Wells



Legend:

- MAJOR THRUST
- KEY UNCONFORMITY
- PLIOCENE
- MIOCENE
- OLIGOCENE
- TRIASSIC (EVAPORITES)
- MESOZOIC (CARBONATES)

NW Albania:
Key Wells at Rodoni – Ishem - Paper Region

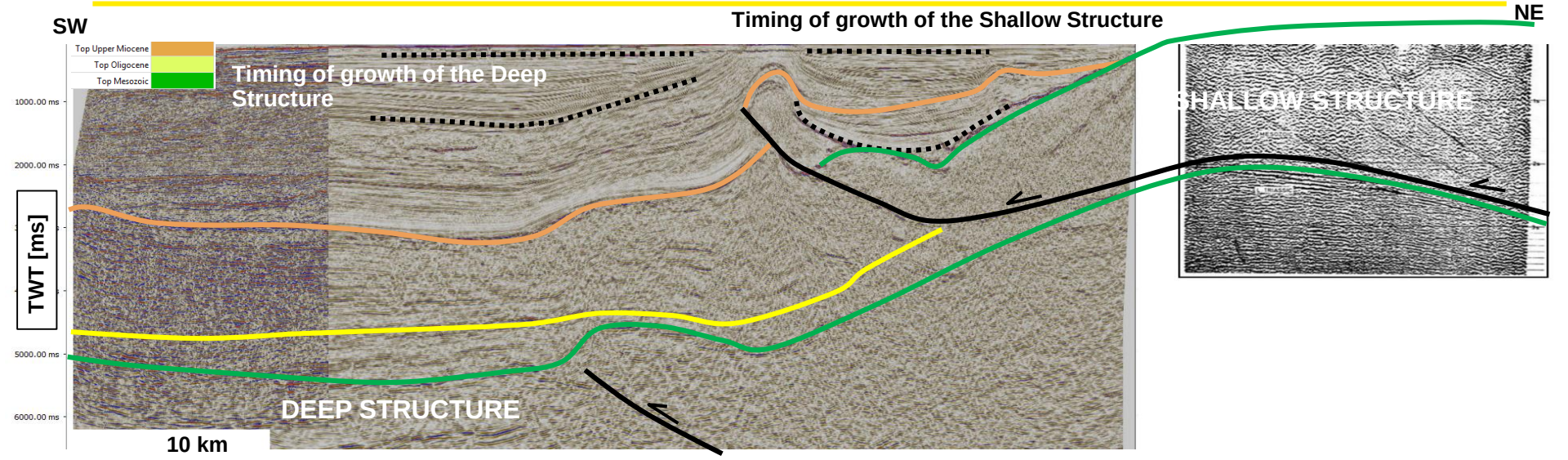


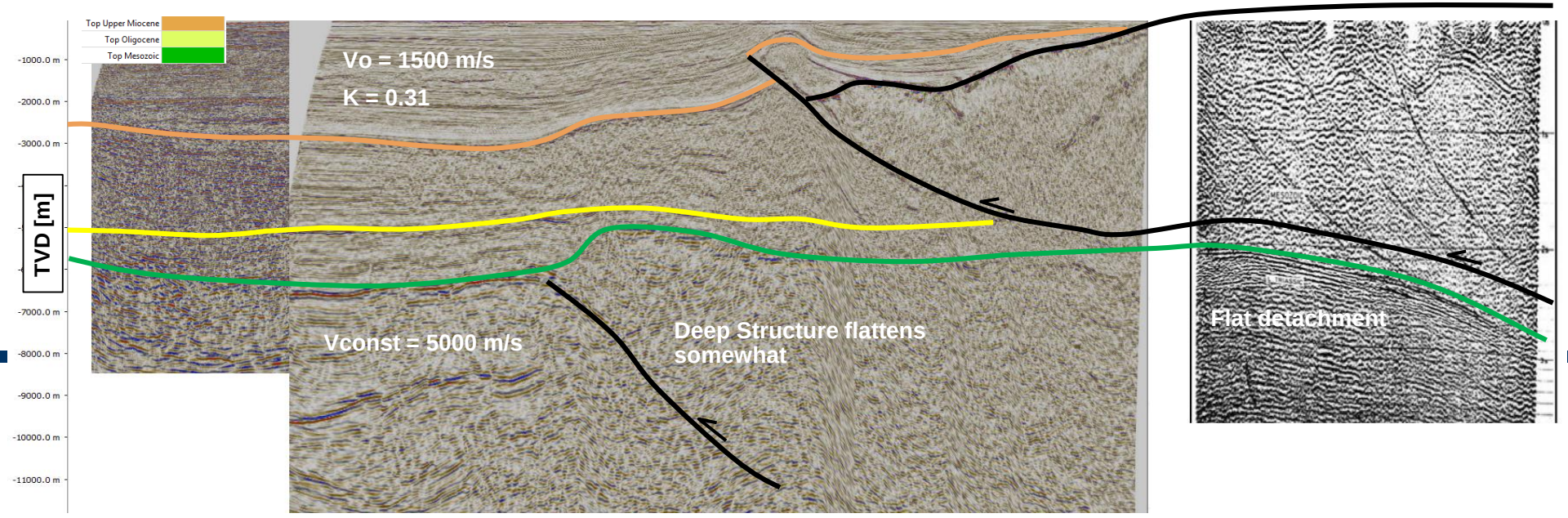
Legend:

- TECTONIC CONTACT
- KEY UNCONFORMITY
- PLIOCENE
- MIOCENE
- OLIGOCENE
- MESOZOIC (CARBONATES)

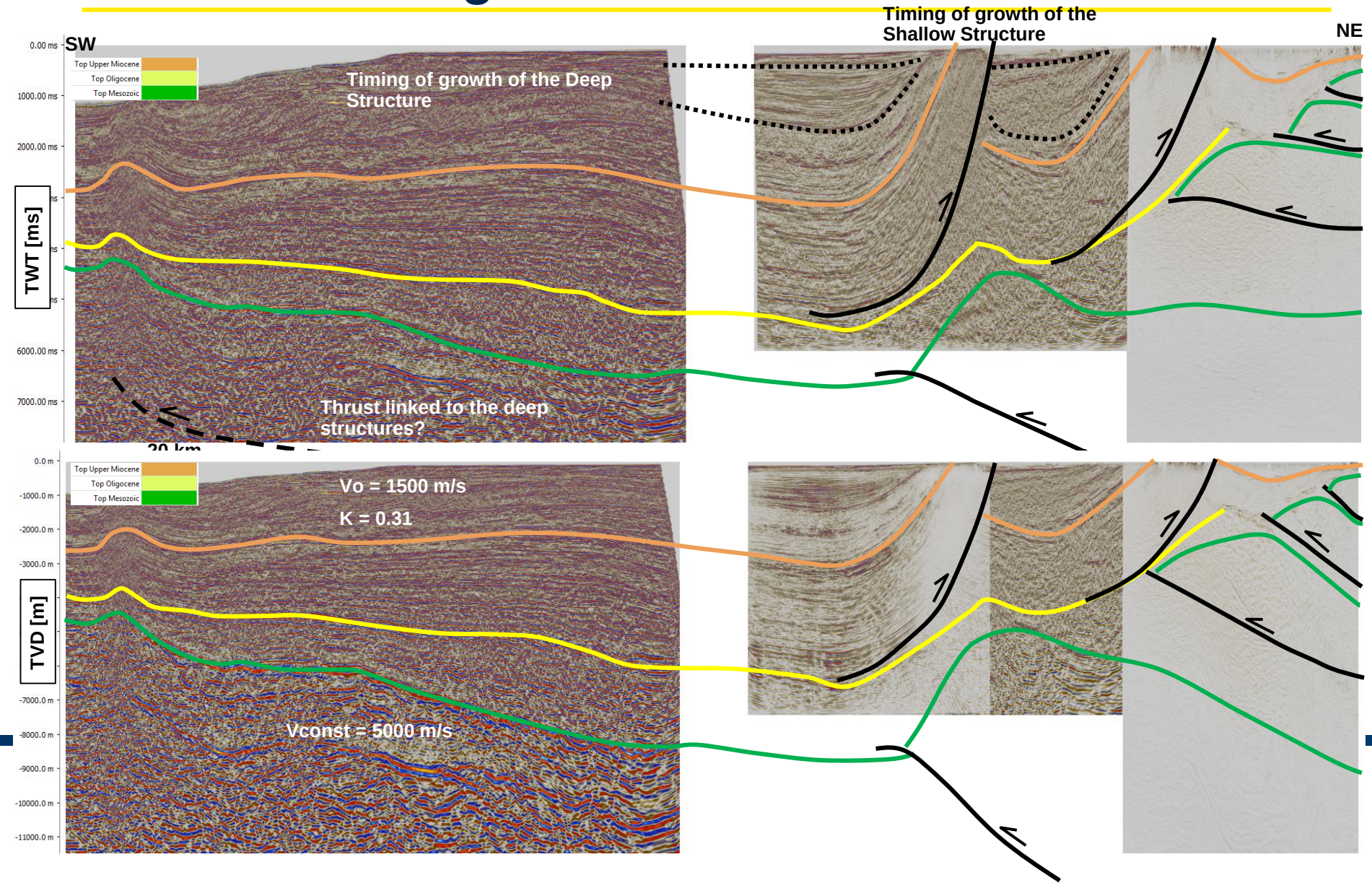
OMV Petrom

Montenegro Regional Line

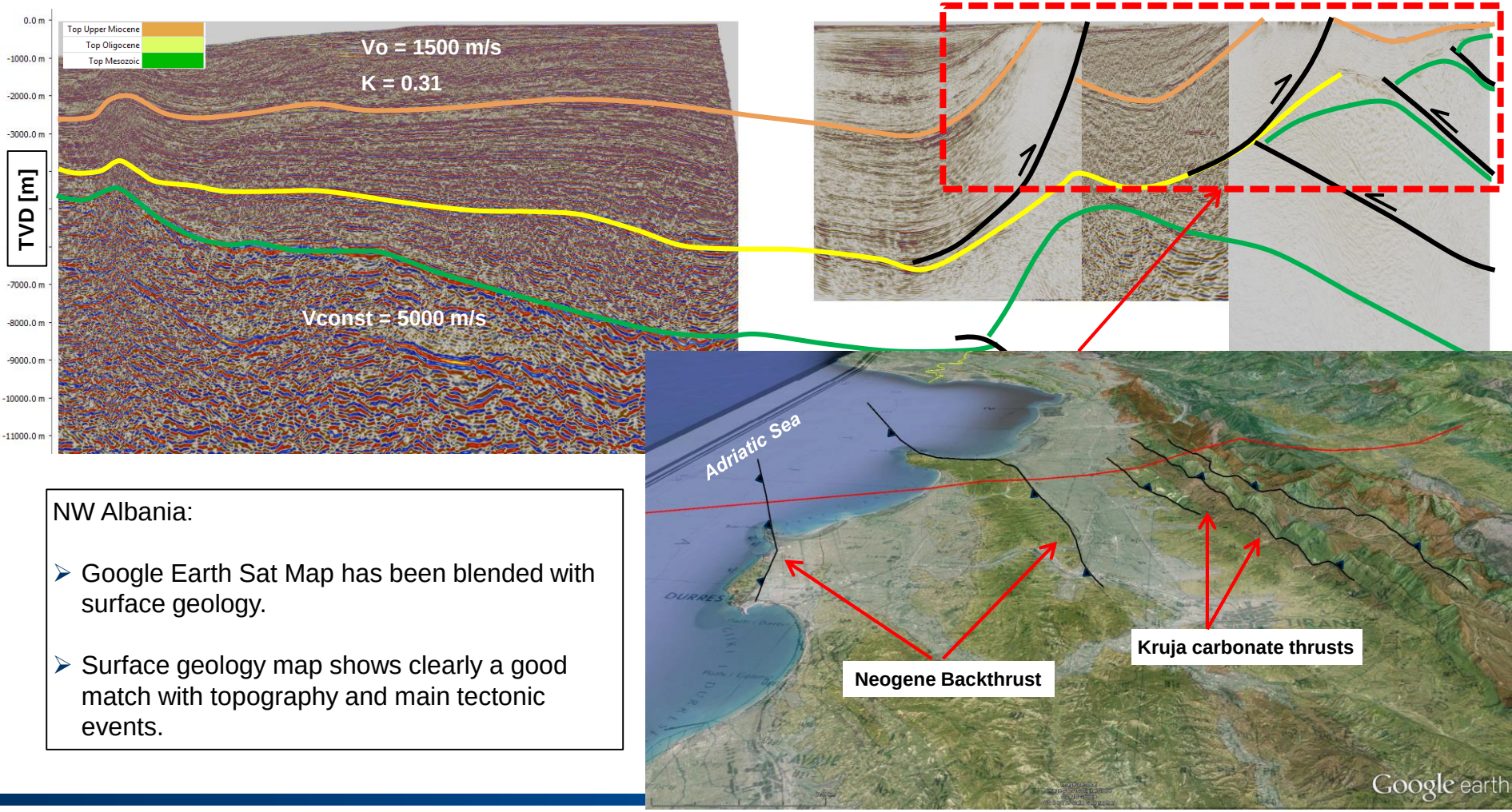




NW Albania Regional Line



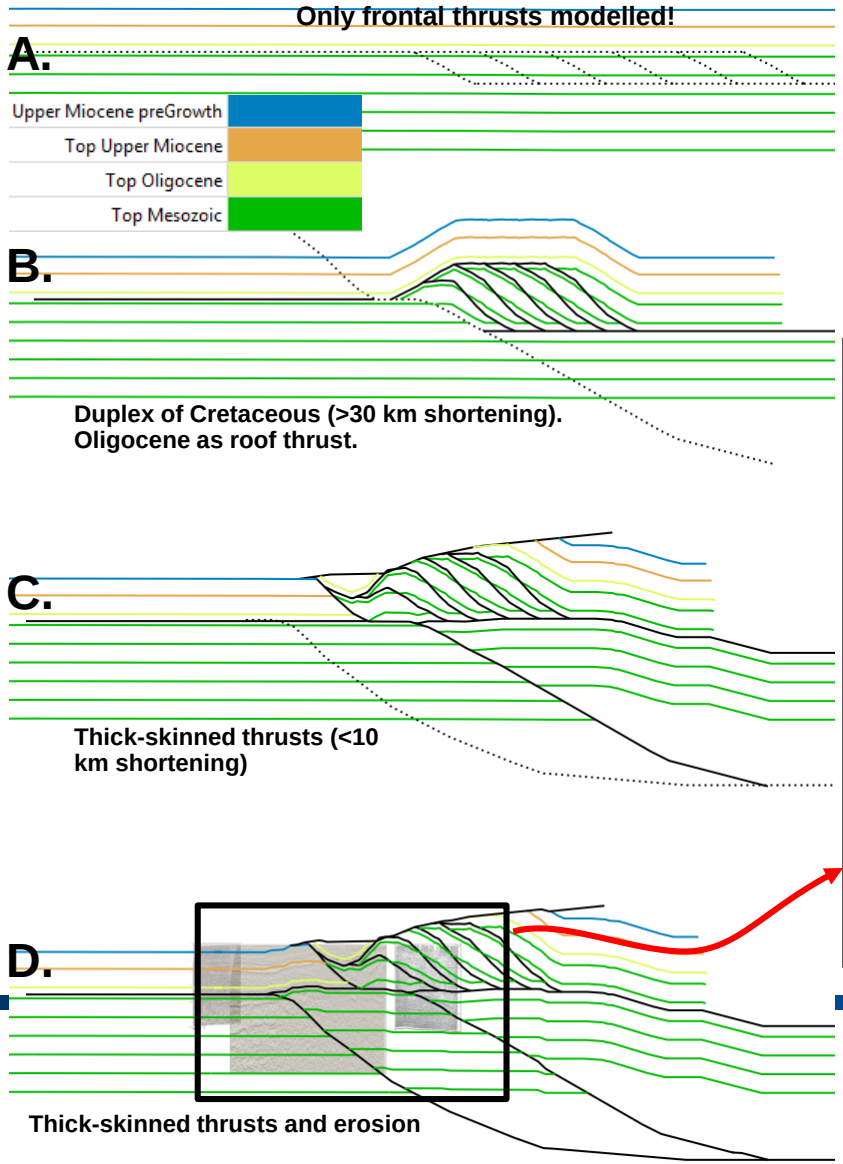
NW Albania Regional Line & Surface Tectonics



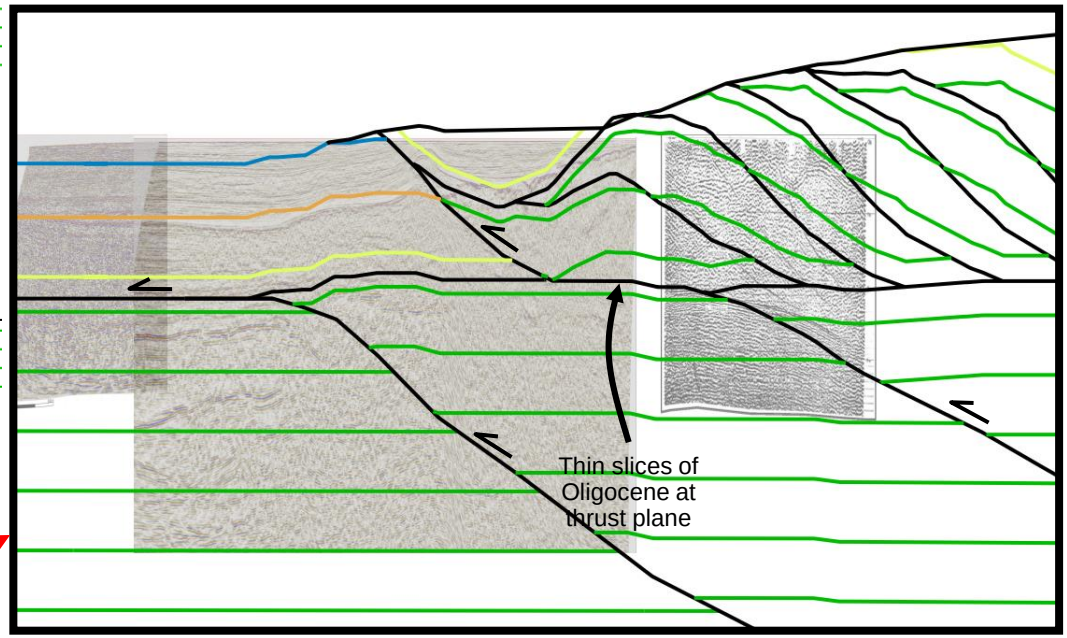
NW Albania:

- Google Earth Sat Map has been blended with surface geology.
- Surface geology map shows clearly a good match with topography and main tectonic events.

Montenegro Regional Line



- Good detachment within Cretaceous (Aptian-Albian shale) and Oligocene (overpressure)
- Cretaceous forms duplexes
- Late thick skinned thrusts uplift area and accommodate a few km's of shortening.

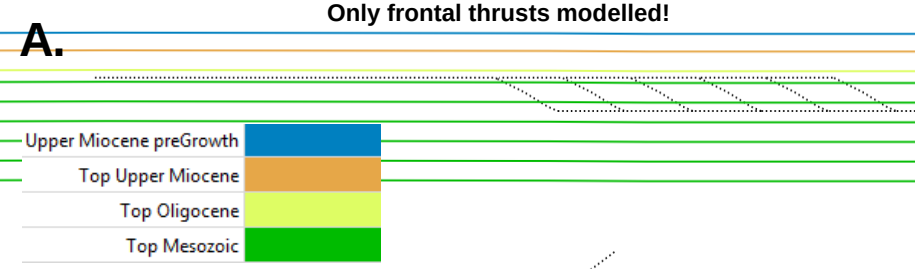


OMV Petrom

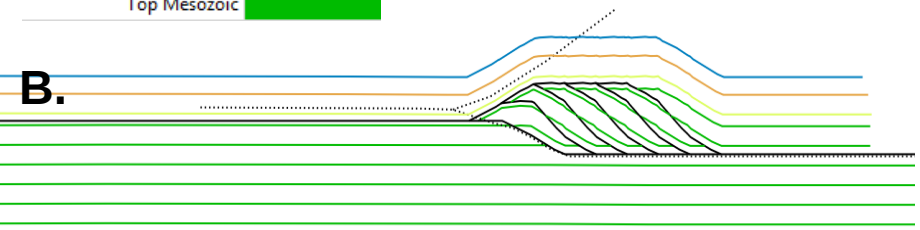
NW Albania Regional Line

Only frontal thrusts modelled!

A.

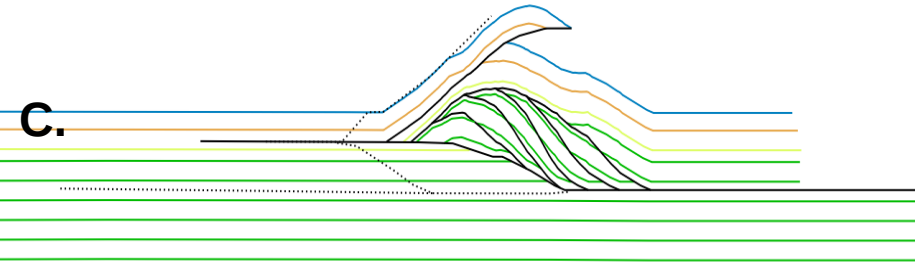


B.



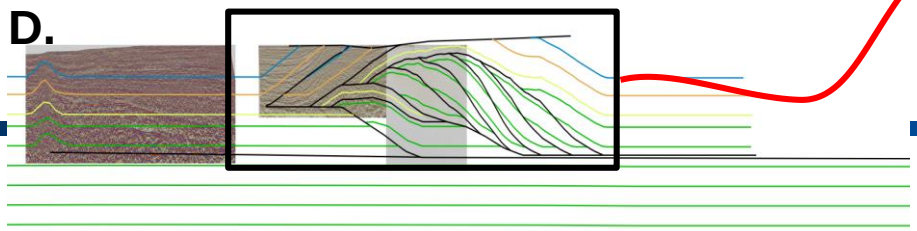
Duplex of Cretaceous (>30 km shortening). Oligocene as roof thrust.

C.



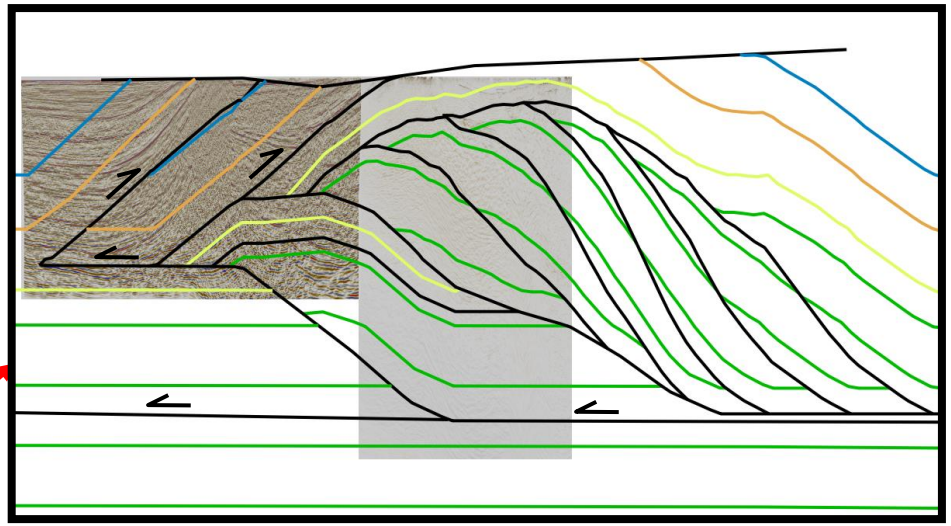
Thick-skinned thrusts (<10 km shortening) and eastern back-thrust.

D.



Thick-skinned thrusts, related back thrust and erosion

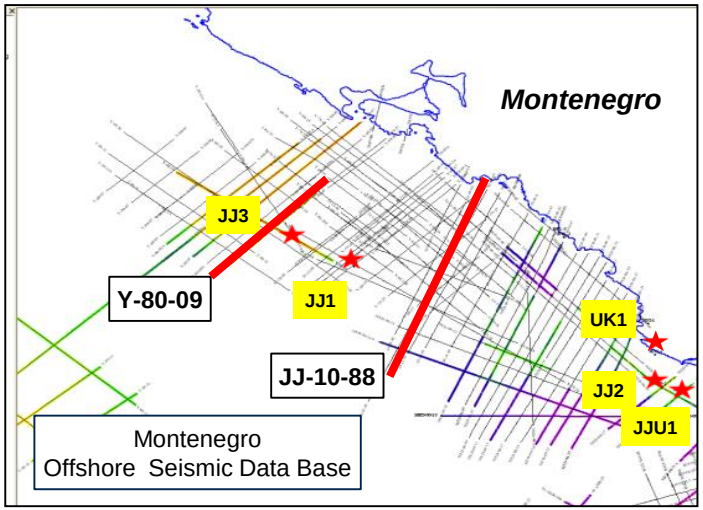
- Good detachment within Cretaceous (Aptian-Albian shales) and Oligocene (overpressure).
- Cretaceous forms duplexes
- Back thrusts follow the same detachment
- Late thick skinned thrusts uplift area and accommodate a few km's of shortening.

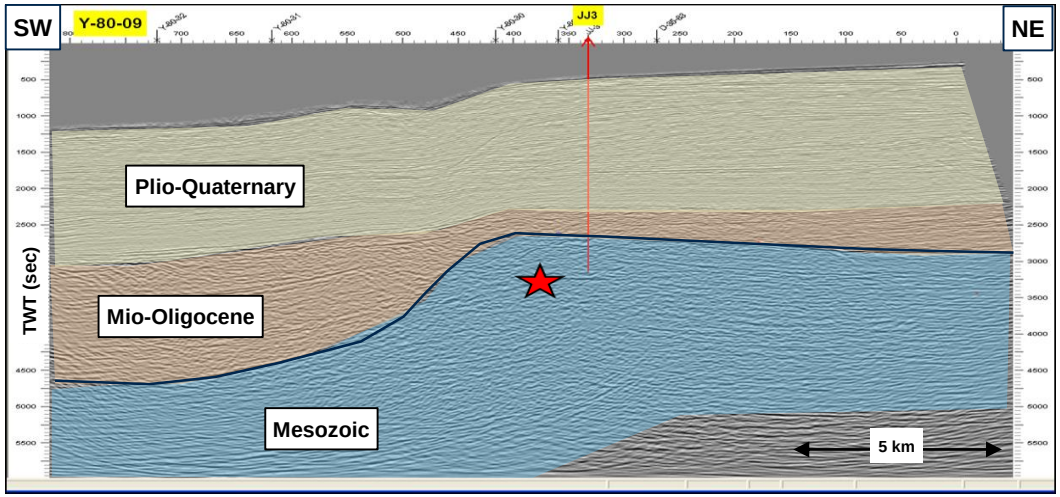


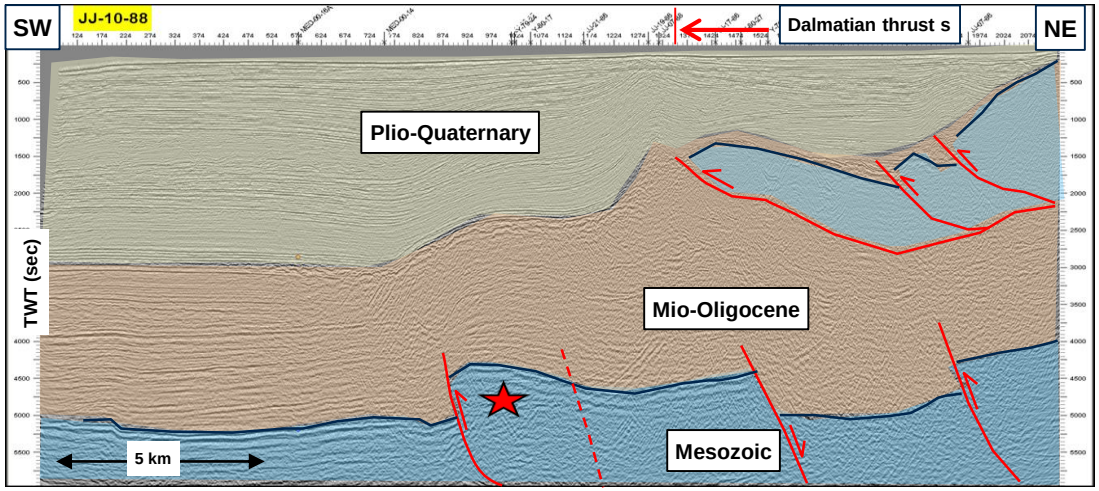
OMV Petrom

Offshore Montenegro

Key Mesozoic Plays – Seismic Examples







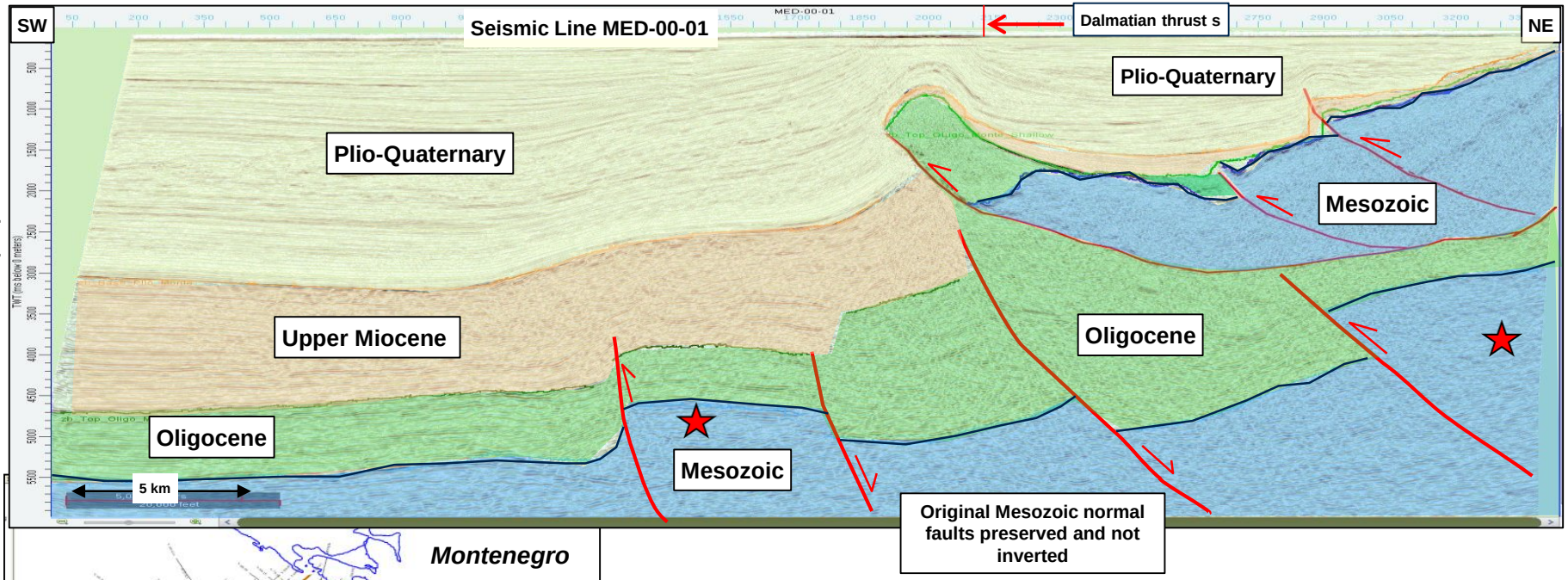
Platform margin, either undeformed or slightly inverted as potential key play.

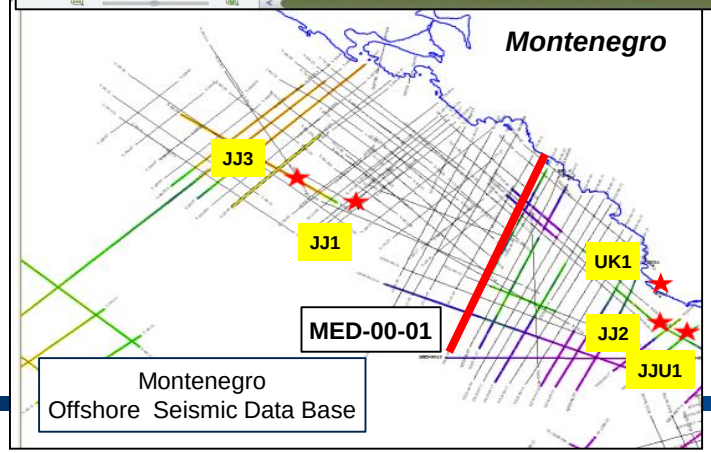
Original normal faults preserved and not inverted

OMV Petrom

Offshore Montenegro

Key Mesozoic Plays – Seismic Examples



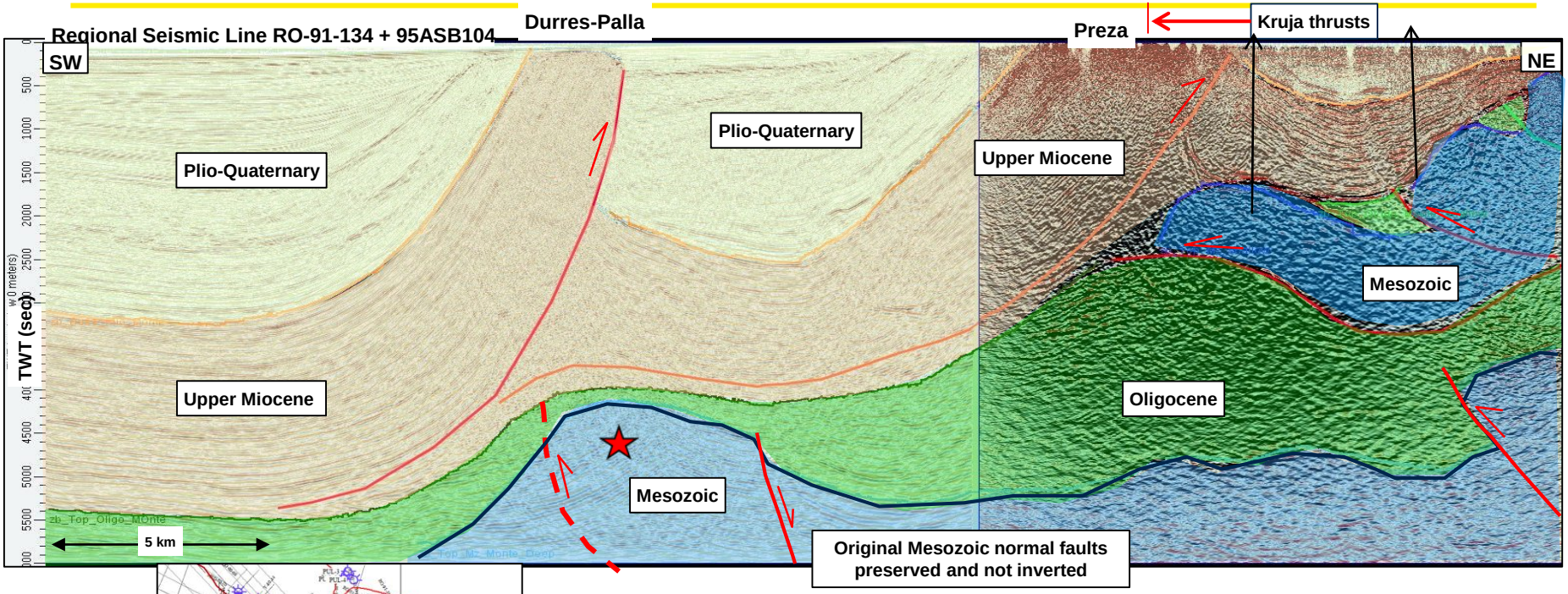


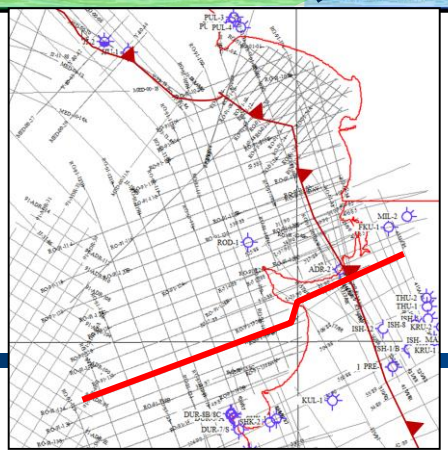
- Platform margin, either undeformed or slightly inverted as potential key play.
- Dalmatian thrusts are considered as high risk play.

OMV Petrom

Off - Onshore NW Albania

Key Mesozoic Play – Seismic Examples

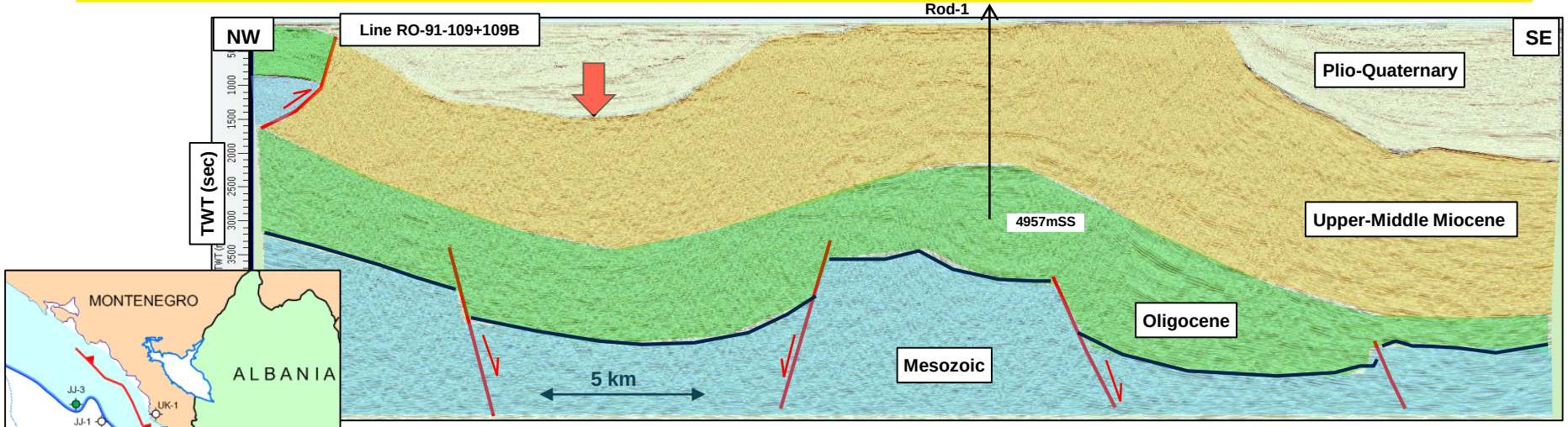




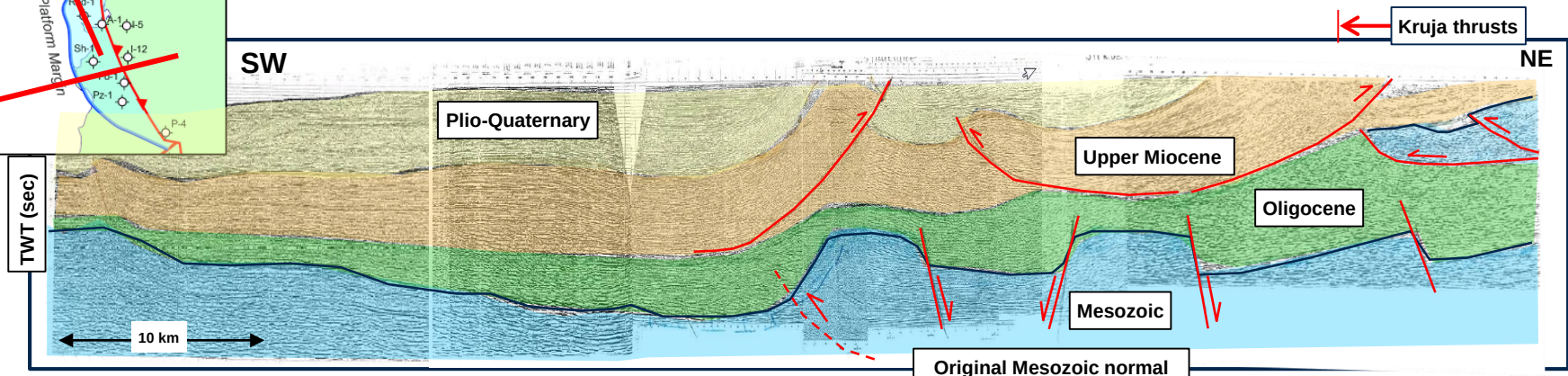
- Spectacular Neogene backthrusts: Durres-Palla; Preza
- Platform margin, either undeformed or slightly inverted as potential key play.
- Kruja (Dalmatian) thrusts are considered as high risk play.

OMV Petrom

SPL Evidences and Rodoni High



- Platform margin and buried hills, sealed by Oligocene shales.



OMV Petrom

Conclusions

- Structural forward modeling helps to constrain the structural model of the Apulian Foreland SE border.
- The Dalmatian-Kruja Mesozoic carbonates have been subject of >30km of shortening in a thin-skinned style (hangingwall).
- The Mesozoic carbonates (foot wall) have been subject of < 10km shortening in a thick skinned manner.
- The Mesozoic thick-skin traps are considered of low exploration risk:
  - platform margin; buried hills or inverted structural highs.
  - In-situ and mature source rocks.
  - Oligocene shales as regional seal.

References

BEGA, Z., 2013. Deep seated platform carbonate reservoirs as new hydrocarbon plays in the NW Albania-Montenegro segment of the Adriatic region, AAPG Conference, Barcelona, 8-10 April, 2013.

BEGA, Z., Schleder, Z., 2016, Review of Mesozoic Exploration Plays in the Montenegro – NW Albania Segment of South Adriatic Basin, AAPG European Regional Conference, Bucharest 19-20 May 2016.

BERTELLO., F., FANTONI, R., FRANCIOSI, R., GATTI, V., GHIELMI, M., and PUGLIESE, A., 2010?, Petroleum Geology: From Mature Basins to New Frontiers – Proceedings of the 7th Petroleum Geology Conference, 113-126. VINING, B. A. & PICKERING, S.C. (eds), Petroleum Geology Conferences Ltd. Published by Geological Society, London.

CURI, F., 1993. Oil generation and accumulation in the Albanides Ionian basin. In: A. M. Spencer (Ed.), Generation, Accumulation and Production of Europe's Hydrocarbons III, EAPG Special Publication 3, p. 281-293.

DIAMANTI, F., 1995. Development of Oil Industry in Albania and Intelectual contribution. In: Recent Developments in Exploration and Oil Production and the future in Free Market Economy, ALBPETROL-95 Sympozium, Nov. 23-26, 1995, Fier, Albania.

DRAGASEVIC, T., 1983, Oil geological exploration in the Montenegro Offshore in Yugoslavia, Nafta 34 (7-8) 397-404.

DRAGASEVIC, T., 1987. Dinarides – a challenge to Yugoslav geophysicists: First Break, 5, 5, 173-183.

DUBLJEVIC, V., 2013. Oil and gas in Montenegro. Ministry for Economic Development, Government of Montenegro. World Wide Web Address: http://mek.gov.me/

GLAVATOVIC, B., 2007. Seismogenic model for Montenegro: Overview of relevant data. First Workshop for the Nato Science for Peace Project, No. 983054, 7-9 November 2007, Slovenia

JERINIC, G., JELASKA, V. and ALAJBEG, A., 1994, Upper Cretaceous Organic-Rich Laminated Limestones of the Adriatic Carbonate Platform, Island of Hvar, Croatia. AAPB Bulletin, V. 78, No. 8, (August 1994). P. 1313-1321.

FLORES, G., 1991, Introduction to the petroleum geology of the Italian offshore. At Sedimentary basins of Mediterranean margins, F.C.Weel (Editor), 505-520, C.N.R Italian Project of Oceanography.

FRASHERI, A., KAPEDANI, N., LICO, R., CANGA, B. and JARECI, L., 1995. Geothermy of External Albanides. In: Recent Developments in Exploration and Oil Production and the future in Free Market Economy, ALBPETROL-95 Sympozium, Nov. 23-26, 1995, Fier, Albania.

FRASHERI, A., BUSHATI, S. and BARE, V., 2009, Gophysical outlook on structure of the Albanides, Journal of Balkan Geophysical Society, Vol. 12, No.1, Dec 2009, 9-30.

MALVIC, T., DUREKOVIC, M., SIKONJA, Z., COGELJA, Z., ILJAS, T., nad KRULJAC, I., 2011, Exploration and production activities in northern Adriatic Sea (Croatia), successful joint venture INA (Croatia) and ENI (Italy)., NAFTA 62 (9-10) 287-292.

References – Cont.

MATTAVELLI, L., NOVELLI, L and ANELLI. L, 1991, Occurance of hydrocarbons in the Adiatic basin. In: A. M. Spencer (Ed.), Generation, Accumulation and Production of Europe's Hydrocarbons III, EAPG Special Publication 3, 369-380.

MATTAVELLI, L., PIERI, M., and GROPPI. G., 1993, Petroleum exploration in Italy: a review. Marine and Petroluem Geology, 1993, Vol. 10.

MOLDOWAN, J. M., SUNDARARAMAN, P., SALVATORI, T., ALAJBEG, A., GJUKIC, B., LEE, C. Y. and DEMAISON, G. J., 1992. Source correlation and maturity assessment of select oils and rocks from the Central Adriatic Basin (Italy and Yugoslavia). In: Biological markers in sediments and petroleum, J.M. Moldowan, P. Albrecht and R.P. Philp (Eds), Prentice Hall, Englewood Cliffs, N.J., 352p.

MOORKENS, T. and DOHLER, M., 1994. Albania. In: H. Kulke (Ed.), Regional petroleum geology of the world: Part I: Beitraege zur regionalen Geologie der Erde, 21, part 1, 325-342.

NIUWLAND, D. A., B. C. OUDMAYER, B. C. and VALBONA, U., 2001. The tectonic development of Albania: Explanation and prediction of structural styles. Marine and Petroleum Geology, 18, 161-177.

PICHA, F. J., 2002. Late orogenic strike-slip faulting and escape tectonics in frontal Dinarides-Hellenides, Croatia, Yugoslavia, Albania, and Greece. AAPG Bulletin, 86, 1659-1671.

PICHA, F. J, 1996. Exploring for hydrocarbons under thrust belts – a challenge new frontier in the Carpathians and elsewhere. AAPG Bulletin, 80, 10, 1547-1564.

RADULEVIC, V., RADULEVIC, M., 1997. Karst Crne Gore (Karst of Montenegro). In: Stefanovic Z. (Ed.), 100 Godina hidrogeologije u Jugoslaviji, Belgarde (1997); 147-185 (in Serbian, with English summary).

ROURE, F., NAZAJ, S., MUSHKA, K., FILI, I., CADET J.–P. and BONNEAU M., 2004. Kinematic evolution and petroleum systems – An appraisal of the Outer Albanides. In: K. R. McClay, (Ed.), Thrust tectonics and hydrocarbon systems: AAPG Memoir 82, 474-493.

ROURE, F., ANDRIESSEN, P., CALLOT, J., L., FAURE, H., FERKET, H., GONZALES, E., GUILACOMBE, N., MALANDAIN, J., SASSI, W., SCHNEIDER, F., SWENNEN, R., and VILASI, N., 2010, The use of palaeo-thermo-barometers and coupled thermal, fluidflow and pore-fluid pressure modelling for hydrocarbon and reservoir prediction in fold and thrust belts. Geological Society, London, Special Publications 2010; v. 348; p. 87-114.

References – Cont.

SCHMID,M. S., BERNOULLI, D., FUGENSCHUH, B., MATEENCO, L., SCHEFER, S., SCHUSTER, R., TISCHLER, M., and USTASZEWSKI, K., 2008. The Alpine-Carpathian-Dinaridic orogenic system: correlation and evolution of tectonic units. Swiss Journal Geoscience, Basel,

SEJDINI, B., CONSTANTINESCU, P. and PIPERI, T., 1994. Petroleum Exploration in Albania. In: B. Popescu, (Ed.), Hydrocarbons of eastern central Europe: Heidelberg, Springer-Verlag, p.1-28.

SHEHU, H., 1995. Structural model of Kruja Zone and its exploration perspective. In: Recent Developments in Exploration and Oil Production and the future in Free Market Economy, ALBPETROL-95 Symposium, Nov. 23-26, 1995, Fier, Albania.

SPERANZA F., ISLAMI, I., KISSEL, C. and HYSENI, A., 1995. Paleomagnetic evidence for Cenozoic clockwise rotation of the external Albanides. Earth and Planetary Science Letters, 129, 121-134.

VEIZAJ. V., and FRASHERI, A., 1995, The relation of orogene in Albanides with Apulia Platform through Gravity Studies. In: Recent Developments in Exploration and Oil Production and the future in Free Market Economy, ALBPETROL-95 Symposium, Nov. 23-26, 1995, Fier, Albania.

VELAJ, T., 2012, Tectonic style and hydrocarbon evaluation of duplex Kruja Zone in Albania, NAFTA, 63 (7-8) 236-242.

ZAPPATERRA, E., 1990. Carbonate Paleogeographic Sequences of the Periadriatic Region, Bolletino Societa Geologico Italiana, 109, 5-20.

ZAPPATERRA, E., 1994. Source rock distribution model of the Periadriatic region. AAPG Bulletin, 78, 3, 333-354.